

**A REVIEW OF THE VELIID FAUNA OF BROMELIADS,
WITH A KEY AND DESCRIPTION OF A NEW SPECIES
(HETEROPTERA: VELIIDAE)**

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Abstract.—Bromeliad inhabiting Veliidae are restricted to the New World tropics, and no exploitation of similar phytotelmata habitats is known among veliids in any other tropical region. The eight species of bromeliadicolous Veliidae occurring in the Neotropical region are discussed, and a key to the species provided. A new species, *Paravelia paolettii* is described from Venezuela.

Among the more interesting ecological segregates within the Neotropical Veliidae is the guild of species restricted to the water pockets of terrestrial and arboreal bromeliads. Including the new species proposed herein, eight species of Veliidae are now known which are apparently restricted to this unusual microhabitat. Of these, four species belong to the genus *Microvelia* Westwood and four species to the genus *Paravelia* Breddin. To date these are the only genera of surface dwelling Heteroptera recorded from this habitat, although members of the subaquatic family Corixidae are also found there on rare occasions. Outside of the original species descriptions mentioning the bromeliad habitat, no review of these interesting insects has appeared except for a brief discussion in Drake and Hussey (1954).

All Veliidae so far known from container habitats are restricted to the New World; these habitats include bromeliads (treated in greater detail below), crab holes (with two apparently obligate species of *Microvelia*, *M. oraria* Drake and *M. inquilina* Polhemus and Hogue, both from Costa Rica; see Polhemus and Hogue, 1972 for discussion), and tree holes (*Paravelia mysersi* Hungerford from Trinidad; see Hungerford, 1931). *Microvelia atrata* Bueno from the southeastern United States occurs in the dark recesses of hollowed out cypress tree boles and so might also be included in this ecological assemblage.

The veliid species that we have collected in bromeliads are usually found between the rather tightly fitting leaves in the center of the plant which trap rainwater in a series of deep pockets, and never occur in bromeliads that lack such water pockets. Among the taxa involved, the *Paravelia* species appear to prefer ground dwelling bromeliad species, while the *Microvelia* species have been taken from both terrestrial and arboreal bromeliads. *Paravelia* and *Microvelia* are in different subfamilies (Veliinae and Microveliinae respectively), so it is clear that adaptation to the bromeliad habitat has occurred on at least two separate occasions. Even so, there are convergent similarities in appearance among all bromeliadicolous species. The macropterous forms possess bright yellow or white spots on the hemelytra, and in the genus *Paravelia*

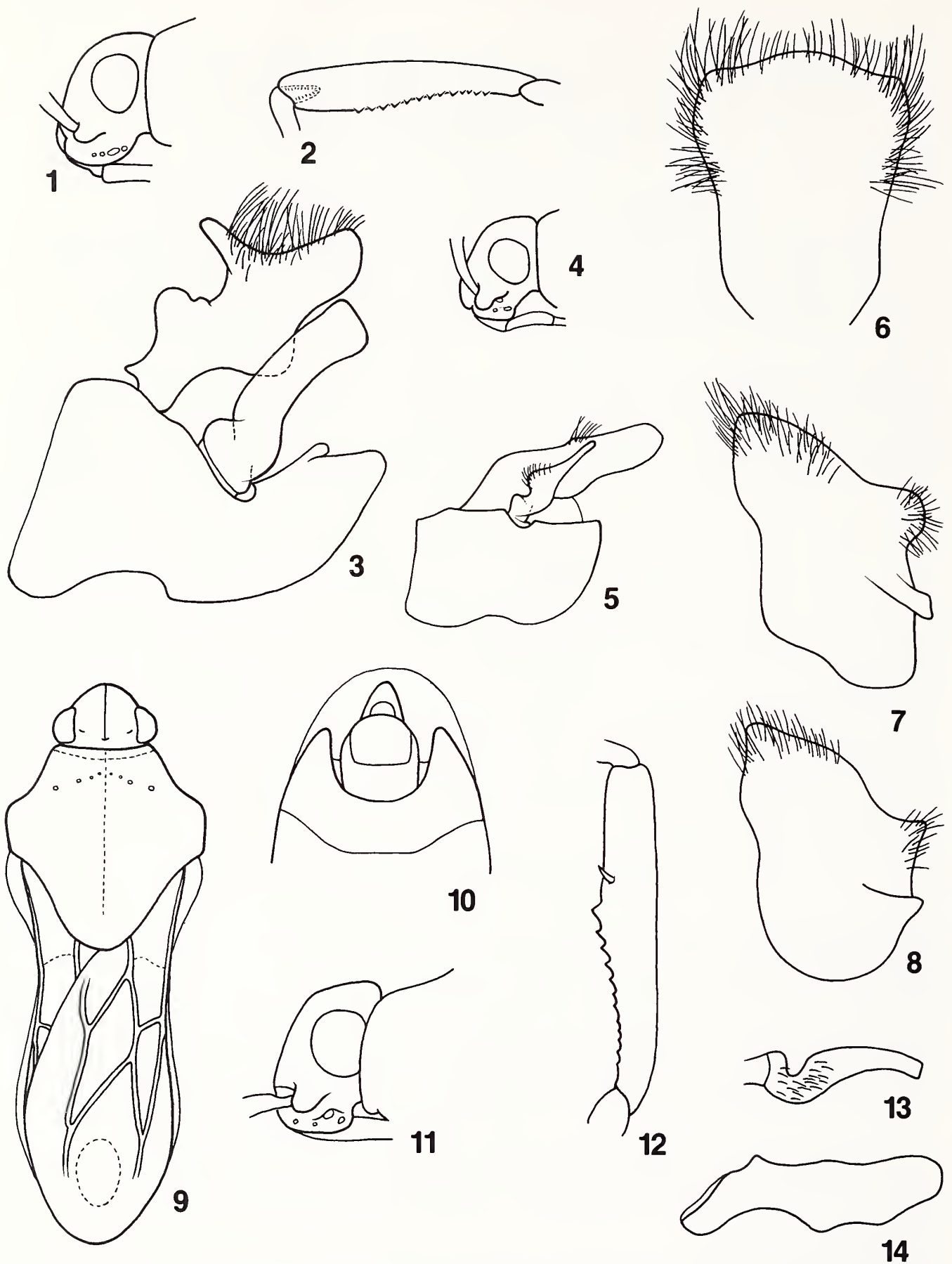
only this morph is known. In *Microvelia* every known bromeliad inhabiting species has in addition either a micropterous or an apterous morph with light markings dorsally in the same position as the light wing spots of the winged morph; in *M. laesslei* these are white micropterous wing pads, in *M. distanti* they are a combination of light colored regions of the integument and silvery pubescent areas, and in *M. ancona* and *M. oaxacana* they are simply bright silvery pubescent areas.

We have found that bromeliadiculous veliids are generally not evenly distributed within a patch of bromeliads, but instead tend to aggregate in certain individual plants. While most bromeliads searched will contain only one or two insects, or more commonly none at all, occasional plants are found which contain up to a dozen. In such preferred plants it is often possible to see one or more specimens in a water pocket using a flashlight, and once located they can sometimes be seen even in ambient light, moving about as ghost-like creatures on the water surface, with only the bright markings visible. The ground dwelling bromeliads that harbor these veliids are often rather large plants which may occur either on the forest floor or on sheer cliffs where collecting is distinctly hazardous. In many instances the plant must be cut off near the base and the leaves peeled away one at a time while each is searched for the veliids, which once exposed run rapidly over the leaf surfaces and attempt to hide in crevices, or move to the dark undersides of the remaining leaves. The most effective way to collect them under such circumstances is by use of an aspirator, with one person dismembering the bromeliad while a second stands ready to suck up the escaping insects.

Most of the specimens upon which this study was based are held in the J. T. Polhemus collection, Englewood, Colorado (JTPC). Abbreviations for depositories of other specimens examined are given in the acknowledgments. All measurements are given in millimeters.

KEY TO THE SPECIES OF BROMELIAD INHABITING VELIIDAE

1. Length greater than 3.2 mm. Tarsal formula 3:3:3 *Paravelia* 2
- 1'. Length less than 2.5 mm. Tarsal formula 1:2:2 *Microvelia* 5
2. At least head bright orange-red. Male hind tarsi not fusiform 3
- 2'. No part of head or body bright orange-red. Male hind tarsi fusiform 4
3. Head and body bright orange-red; hemelytra black with white spots *helenae*
- 3'. Head only bright orange-red; hemelytra black with yellow spots *paolettii*
4. Body markings brownish; hemelytra brownish with white spots; distal hemelytral spot ovate or round, not approaching apex; pronotum anteriorly occasionally orange brown, sometimes with silvery frosting, but never marked with bright yellow *recens*
- 4'. Body markings black; hemelytra black with yellow spots; distal hemelytral spot elongate, reaching apex or nearly so; pronotum anteriorly with bright yellow transverse markings *manausana*
5. Ground color brownish 6
- 5'. Ground color black or blackish gray 7
6. Apterous form brownish with bluish silvery spots on abdominal dorsum; micropterous form unknown; in macropterous form, hemelytra brown with 6 to 8 white elongate spots *oaxacana*
- 6'. Apterous form unknown; micropterous form with oval white wing pads; in macropterous form, hemelytra brown with entire basal $\frac{1}{3}$ white *laesslei*
7. Connexiva entirely dark *ancona*



Figs. 1-14. 1-3. *Paravelia manausana* J. & D. Polhemus. 1. Head, lateral view. 2. Posterior femur, posterior view. 3. Male genitalia, lateral view. Cl = clasper or paramere; Pg = pygophore; Pr = proctiger. 4-8. *Paravelia recens* Drake & Harris. 4. Head, lateral view. 5. Male genitalia, lateral view (Brazil). 6. Male first genital segment, dorsal view (Brazil). 7. Male first genital segment, lateral view (Brazil). 8. Male genitalia, lateral view (Bolivia). 9-14. *Paravelia paolettii* new species. 9. Habitus. 10. Male abdominal terminalia, ventral view. 11. Head, lateral view. 12. Posterior femur, posterior view. 13. Male clasper or paramere. 14. Male proctiger.

- 7'. First three connexival segments white or yellow in both apterous and macropterous forms *distanti*

Paravelia helenae (Hungerford)

Fig. 19

Velia helenae Hungerford 1929. Holotype, female, Peru, Callanga [Dept. Cuzco, 1,500 m], Riksmuseet, Stockholm.

Velia helenae, Polhemus 1969. Description of male; distribution record, Dept. Junin, Peru.

Paravelia helenae, Polhemus 1976:512. New combination.

Discussion. This species was sought for many years by professional collector Felix Woytkowski (1974) at the request of H. B. Hungerford, who had described it from a single female he found in the Stockholm museum. Unfortunately it was not known that the species was an obligate bromeliad inhabitant, so Woytkowski undoubtedly passed close by many populations on his way to search for it diligently in the "normal" aquatic veliid habitats. This elusive species was finally rediscovered in 1965 by Pedro Wygodzinsky, who noted that his specimens came from bromeliads on a cliff.

Material examined. PERU: Dept. Junin: 5 males, 7 females, 1 nymph, Huacapistana, 1,800 m, 30 July 1965, B. & P. Wygodzinsky (AMNH, JTPC).

Paravelia manausana J. & D. Polhemus

Figs. 1-3, 18, 19

Paravelia manausana J. T. Polhemus & D. A. Polhemus 1984:341. Holotype, male, Brazil, Manaus, Zoologische Sammlung des Bayerischen Staates (ZSMC), Munich.

Discussion. This species is most closely related to *Paravelia recens* (Drake & Harris) but may be separated by the characters given in the key and larger size.

When we originally described *P. manausana* we hypothesized that it inhabited bromeliads based on its similarity to *P. recens*, even though we lacked supporting habitat data. This hypothesis was confirmed when we collected the species from water filled leaf axils of terrestrial bromeliads at Reserva Ducke, northeast of Manaus, Brazil. The area in which the species occurred was a "campina" forest growing on poor, sandy soil. Two types of terrestrial bromeliads were present in the understory, a larger one with stiff, spiny-edged leaves and pink flowers, and a slightly smaller one with flexible, smooth edged leaves and no flowers. The veliids were found only in the latter type of bromeliad; a comparison with INPA herbarium specimens indicated that the species in question was probably *Vriesia splitgerberi* Ruby Branga 1975, which occurs on sandy soils from Manaus north to Roraima. Only three specimens of *P. manausana* were taken, all from the same plant. By contrast, *P. recens* was common, occurring in nearly every water-bearing plant examined.

We also collected *P. manausana* in Bolivia from large terrestrial bromeliads growing on cliffs in the Rio Coroico gorge above Caranavi. These bromeliads were restricted to very sheer rock faces, and required ropes to reach. As at the Reserva Ducke locality, there were two types of terrestrial bromeliads at this site, a stiff spiny one and a flexible, smooth-leaved one, with the veliids occurring only in the latter. It appears that this preference for the smooth-leaved bromeliads is due in part to

their superior water holding ability, even though their lack of spines offers less protection from potential predators. Once again *Paravelia recens* occurred sympatrically in the same plants at this locality.

The male pygophore of *P. manausana* is distinctively sculptured (Fig. 3), but differs somewhat between the two series mentioned above. We originally thought the Bolivian population represented a new species, but have concluded that the variability does not warrant the proposal of a new taxon, because most important characteristics are very similar, and there is also variation within any given population.

In our original paper (Polhemus and Polhemus, 1984) specimens of *P. recens* were included in the type series of *P. manausana* by error. These are relisted in the present work in the material examined section under *P. recens*.

In addition to the Brazilian host plant record, a single specimen is also at hand from Ecuador which was intercepted by U.S. Customs at the Miami airport on a bromeliad belonging to the genus *Guzmania*.

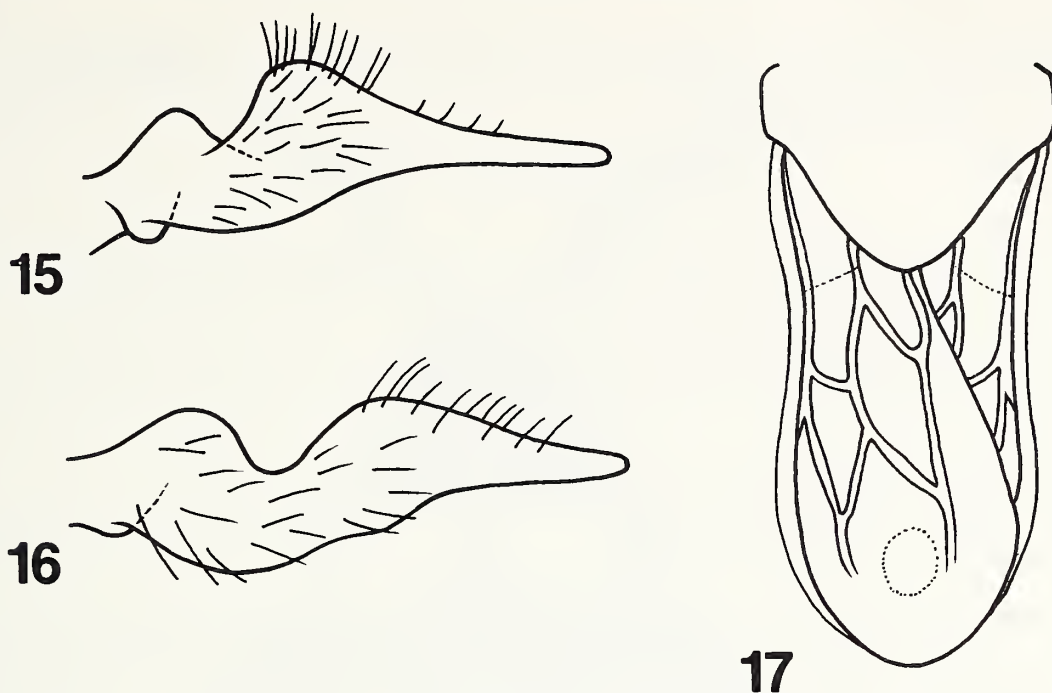
Material examined. BOLIVIA: Dept. La Paz: many males and females, Rio Coroico gorge, 28 km W Caranavi, bromeliads on cliffs, CI 2523, 15 November 1989, J. T. & D. A. Polhemus (IELB, JTPC). BRAZIL: Amazonas: Type-series, 3 males, 3 females, Manaus, Rio Branco, 4 December 1969, E. J. Fittkau (ZSMC, JTPC); 2 males, 1 female, nr. Manaus, Reserva Ducke, Ig. Acará, bromeliads [*Vriesia splitgerberi*?] on forest floor, CI 2476, 26 August 1989, J. T. & D. A. Polhemus (INPA, JTPC). ECUADOR: 1 female, on *Guzmania* sp., intercepted at Miami, 2 June 1988, W. C. James (USNM). PERU: Dept. Pasco: 1 female, Pan de Azucar, 13 July 1961, F. S. Truxal (LACM). VENEZUELA: T. F. Amazonas: 3 males, 5 females, 5 immatures, Cerro Unturan Camp, 65°14'W, 01°33'N, 1,100 m, 11–15 February 1989, from large terrestrial bromeliad, Phipps- FUDECI Exped. by American Mus. Nat. Hist., D. A. Grimaldi (AMNH).

Paravelia paolettii, new species

Figs. 9–14, 19

Description. Macropterous male: Ground color blackish brown, venter somewhat lighter; pronotum without anterior transverse band. Head orange-red, with a few small yellowish dorsal spots; distal ends of antennal tubercles, bucculae yellowish; rostrum yellow brown, darker distally. Legs, antennae dark brown except antennal segment 1 basally lighter. Head short, declivant anteriorly; bucculae prominent, short (Fig. 11); length of head 0.58; width of eye/interocular space, 0.20/0.53. Pronotum long, humeri prominent; weakly carinate on midline, carina evanescent posteriorly; set with shallow poorly defined pits; disc raised; posterior margin rounded distally; length: width, 1.88:1.85. Length of hemelytra from basal angle to apex, 7.00.

Dorsum clothed with short semi-erect pubescence, hemelytra without setae except along lateral margins. Abdominal venter not modified, bearing short appressed setae. Legs, antennae thickly clothed with short to moderate length setae, without long setae. Posterior trochanter unarmed. Middle femur medially set beneath with 3 small spines or denticles, increasing in length distally. Posterior femur denticulate from base to distal $\frac{2}{3}$, denticles increasing in length distally, distal spine somewhat offset posteriorly. Posterior tibia beneath unarmed. Claws small, only slightly preapical; downcurving arolia of hind tarsi not visible.



Figs. 15–17. *Paravelia recens* Drake & Harris. 15. Male clasper or paramere (Brazil). 16. Male clasper or paramere (Bolivia). 17. Habitus, partial.

Antennal formula I:II:III:IV; 0.80:0.56:0.56:0.56.

Proportions of legs as follows:

	femur	tibia	tarsal 1	tarsal 2	tarsal 3
Anterior	1.55	1.33	0.08	0.20	0.33
Middle	1.83	1.80	0.05	0.30	0.33
Posterior	2.25	2.80	0.08	0.45	0.43

Abdominal sternite VII unmodified. Abdominal terminalia as shown in figure 10. Proctiger with a small median dorsal tubercle (Fig. 14); paramere long, distally truncate (Fig. 13).

Length, mean = 5.25 mm, N = 1.

Width, mean = 1.92 mm, N = 1.

Apterous male, Apterous female, Macropterous female: Unknown.

Material examined. Holotype, macropterous male: VENEZUELA: Aragua: Parque [Nacional Henri] Pittier, Rancho Grande, bromeliads, BR-3-tree 2, January 1988, M. G. Paoletti (JTPC). In the same sample was also 1 immature.

Etymology. This species is named for the collector of the only known specimens of this species, Dr. M. G. Paoletti.

Discussion. This species is most closely related to *Paravelia helenae* (Hungerford) but is larger and the armature of the legs is less well developed. The buccula of *P. paolettii* has a broad deep fovea (Fig. 11), while in *P. helenae* the same fovea is much smaller. These species share the following characters: striking orange-red and black coloration with contrasting light colored spots on the dark hemelytra; middle femur and hind femur denticulate ventrally; habitat in bromeliad water pockets. In *P. paolettii* the head is orange-red, the entire body black, and the entire basal angle of the hemelytra is yellow, whereas in *P. helenae* the head and body are orange-red, the

hemelytra black, and a basal spot on the hemelytra is white and separated from the base; both have a distal ovate light spot on the hemelytra.

Paravelia recens (Drake & Harris)

Figs. 4–8, 15–17, 19

Velia recens Drake & Harris 1935:192. Holotype, macropterous male, Panama, USNM.

Velia recens, Drake & Maldonado 1952:48. Habitat notes; distributional records, British Honduras (Belize), Venezuela.

Velia recens, Drake & Hussey 1954:133. Habitat notes; distributional records, Brazil, Guyana.

Paravelia recens, Polhemus 1976:512. New combination.

Paravelia recens, J. & D. Polhemus 1984:341, Fig. 6. Comparison with *P. manausana*, male paramere; distribution, Brazil.

Discussion. Because of morphological differences between populations of this species, we originally thought that several species were involved, however the characters we studied seem to vary independently, and major features such as head shape and femoral armature are quite constant. We examined details of the parameres, proctiger and first genital segment, the complement of denticles on the head and prosternum, the coloration of the pronotum, the shape and position of the light areas on the hemelytra, the relative lengths of the antennae, legs and tarsal segments, and the details of the male abdominal venter in an effort to clearly delineate separate taxa within the material at hand. We conclude that whereas there are differences between populations, we are most likely dealing with a single very widespread, and somewhat variable species.

Considering its apparently obligate restriction to bromeliad water pockets, the range of *P. recens* is remarkable, extending from Honduras to Bolivia. It has been found in both terrestrial and arboreal bromeliads belonging to a number of different genera and species, and therefore appears to be a generalist in regard to host choice. For a further description of habitats in which this species occurs see the discussion under *P. manausana*.

Drake and Maldonado (1952) noted that they had seen specimens of *P. recens* from British Honduras, but this may have been an error since the Drake collection contains only specimens from Honduras proper.

Material examined. BOLIVIA: Dept. La Paz: many males and females, Rio Coroico gorge, 28 km W Caranavi, bromeliads on cliffs, CI 2523, 15 November 1989, J. T. & D. A. Polhemus (IELB, JTPC). BRAZIL: Amazonas: 2 males, 2 females, Cachoeira, Rio Cuieiras, A 76, 16 December 1960, E. J. Fittkau (erroneously listed as paratypes of *P. manausana* by Polhemus and Polhemus, 1984) (ZSMC, JTPC); 1 male, 1 female, Manaus, A-439, Rio Branco, 4 December 1969, E. J. Fittkau (JTPC); 3 males, Rio Negro, A-405, Rio Taruma, 11 November 1962, E. J. Fittkau (JTPC); 5 males, 6 females, nr. Manaus, Reserva Ducke, Ig. Acará, bromeliads on forest floor [*Vriesia splitgerberi*?], CI 2476, 26 August 1989, J. T. & D. A. Polhemus (INPA, JTPC); Pará: many males and females, Belém, Rio Guamá, ex tank of bromeliad, 21 November 1973, R. T. Schuh (AMNH, JTPC); many males and females, 18 km E Belém, Marituba, ex tank of *Aechmea fulgens* (Bromeliaceae), 2 July 1974, R. T. Schuh (AMNH, JTPC). COLOMBIA: Chocó: 2 winged males, 2 winged females,

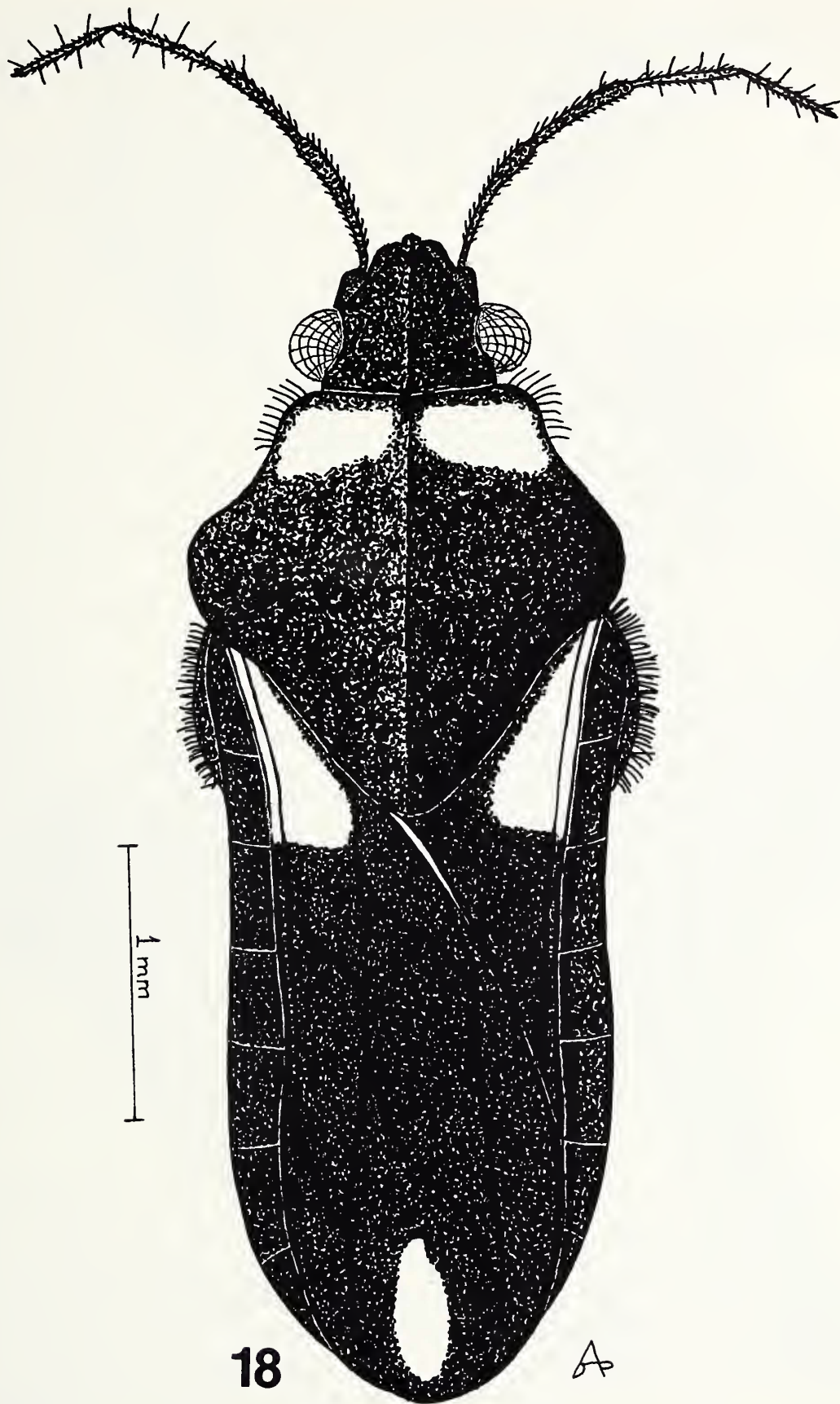


Fig. 18. *Paravelia manausana* J. & D. Polhemus. Dorsal habitus (legs omitted).

Charombirá, associated with *Anopheles* sp. in bromeliads, C. Murillo (UDVC). GUY-ANA: 1 male, 1 female, Bartica Triangle, ex bromeliads on mangrove, October 1948 to March 1949, D. J. Atkinson (JTPC). HONDURAS: 1 male, 1 female, Tela, 6 April [year?], T. H. Hubbell (JTPC). PANAMA: Canal Zone: 1 male, Monte Sirio,



Fig. 19. Distribution of bromeliadicolous *Paravelia* species. Δ = *P. helenae*. \square = *P. manausana*. \circ = *P. recens*. ∇ = *P. paolettii*.



Fig. 20. Distribution of bromeliadicolous *Microvelia* species. Δ = *M. distanti*. \square = *M. oaxacana*. \circ = *M. ancona*. ∇ = *M. laesslei*.

Gatuneillo River, 1956, C. J. Drake (holotype, USNM). PARAGUAY: Dept. Paraguari: 1 male, 1 female, Cerro Acahay, Area rocosa norte de la Cumbre Occidental, 550 m, on bare rock or among many stones, in spiny bromeliad, 30 May 1985, K. A. Kochalka (USNM). PERU: Dept. Pasco: several males and females, Pan de Azucar, 13 July 1961, F. S. Truxal (LACM, JTPC). VENEZUELA: Terr. Fed. Amazonas: 2 males, 2 females, Mt. Marahuaca, N. slopes, Benitez Camp, 1–25 May 1950, J. Maldonado Capriles (JTPC).

Microvelia ancona Drake & Chapman

Fig. 20

Microvelia ancona Drake & Chapman 1954:153. Holotype, macropterous female, Panama, USNM.

Discussion. This species was known only from the female type until several more recently collected series provided apterous forms. In the latter, the bright silvery pubescent areas on the abdominal tergites contrast with the velvety black ground color.

Material examined. COLOMBIA: 1 macropterous male, Chocó, Charambiro, January 1985, R. Astaiza (JTPC). ECUADOR: Napo: 8 apterous males, 3 macropterous males, 5 apterous females, 1 macropterous females, Baeza, 1,900 m, ex tanks of *Aechmea* (?) sp. (Bromeliaceae) (#69), 4 February 1976, R. T. Schuh (AMNH, JTPC). VENEZUELA: Aragua: many apterous and macropterous males and females, Parque [Nacional Henri] Pittier, Rancho Grande, bromeliads, January 89, M. G. Paoletti (JTPC).

Microvelia distanti Lundblad

Fig. 20

Microvelia insignis Distant 1912:437, Pl. X. Holotype, macropterous, sex unknown, El Tucuché, Trinidad, BMNH. Preoccupied by *Microvelia insignis* (Distant) 1903 (originally described in *Rhagovelia*).

Microvelia distanti Lundblad 1933:286. New name.

Microvelia distanti, Drake & Hussey 1954:134. Additional description, based on specimens from the type-locality.

Discussion. This species is apparently common in bromeliads on the summit of El Tucuché in Trinidad. It was also recorded from Dominica by Distant (1912). The record from Venezuela is from very close to the Brazilian border, and a considerable range extension. Spangler and Spangler (in press) provide additional detailed information on the biology of this species at the Cerra de la Neblina locality.

Material examined. TRINIDAD: 1 apterous male, 1 macropterous male, Mt. Tucuché, 2 February 1929, J. G. Myers (BMNH, JTPC). VENEZUELA: Terr. Fed. Amazonas: many apterous specimens, Cerro de la Neblina, Camp VII, 1,850 m, 30 January to 10 February 1985, on water in *Brocchinia tatei* (large bromeliad), P. J. & P. M. Spangler, R. A. Faitoute (USNM, JTPC).

Microvelia laesslei Drake & Hussey

Fig. 20

Microvelia laesslei Drake & Hussey 1954:134. Holotype, micropterous male, Jamaica, USNM.

Material examined. JAMAICA: 1 micropterous male, 1 macropterous male, Jaun de Bolas 2,500', from bromeliads, 1-7 August 1952, A. M. Laessle (paratypes, JTPC); 3 micropterous males, 1 micropterous female, 3 nymphs, St. Ann Mt., Diablo For. Res., ex bromeliad, 14 July 1960, T. H. Farr (JTPC).

Microvelia oaxacana Drake

Fig. 20

Microvelia oaxacana Drake 1951:37. Holotype, apterous male, Mexico, Oaxaca, USNM.

Microvelia oaxacana, Drake & Hussey 1954:136. Description of macropterous form; distributional record, Mexico, D. F.

Microvelia oaxacana, Smith 1980:340. Distributional records, Chiapas and Puebla, Mexico.

Discussion. The specimens examined by Drake were all interceptions at border stations, and *Tillandsia* was the only named associate, the others simply given as "bromeliads." During a 1964 expedition to Mexico, J. T. and M. S. Polhemus collected a number of specimens from large broad leaved bromeliads growing on the horizontal limbs of large oak trees near Montebello Lakes in Chiapas. It was necessary to cut off the base of the plant and peel the leaves away to find the insects.

Material examined. MEXICO: Chiapas: 4 apterous males, 1 apterous female, 1 nymph, Montebello Lakes, ex bromeliads, CL 1082, 3 May 1964, J. T. & M. S. Polhemus (JTPC); Morelos: 1 apterous female, 6.3 mi N Cuernavaca, 29 July 1963, M. G. Naumann (JTPC); Puebla (?): Pueblo (sic), many apterous and macropterous specimens, 4,600 ft, 27 June 1953, I. Shenick (SEMC, JTPC).

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